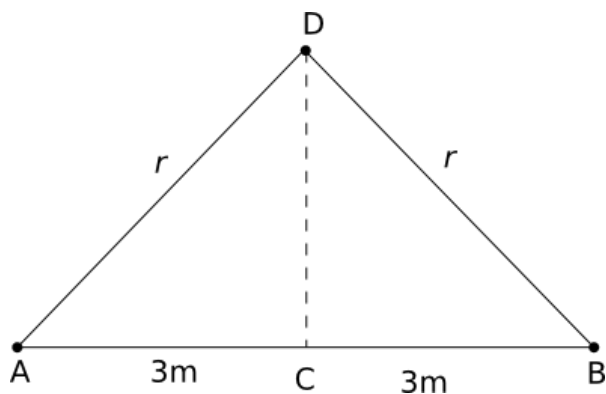


Answer on Question #63444, Physics / Electromagnetism

Two fixed charges A and B of $5 \mu\text{C}$ each are separated by a distance of 6 m. C is the mid point of the line joining A and B. A charge 'Q' of $-5 \mu\text{C}$ is shot perpendicular to the line joining A and B through C with a kinetic energy of 0.06 J. The charge 'Q' comes to rest at a point D. what is the distance between CD?

Solution:



The charge will stop when the increase in potential energy will be the same as initial kinetic energy.

The potential energy of Q at point C is

$$U_1 = \frac{1}{4\pi\epsilon_0} \frac{qQ}{3} \times 2$$

where q is fixed charges A and B.

Potential of Q at point D is

$$U_2 = \frac{1}{4\pi\epsilon_0} \frac{qQ}{r} \times 2$$

The potential energy difference is

$$U_1 - U_2 = \frac{2}{4\pi\epsilon_0} \frac{qQ}{r} \left(\frac{1}{3} - \frac{1}{r} \right) = 2 \cdot 9 \cdot 10^9 \cdot 5^2 \cdot 10^{-12} \left(\frac{1}{3} - \frac{1}{r} \right) = 0.45 \cdot \left(\frac{1}{3} - \frac{1}{r} \right)$$

$$U_1 - U_2 = 0.06 \text{ J}$$

$$\left(\frac{1}{3} - \frac{1}{r} \right) = \frac{0.06}{0.45} = \frac{2}{15}$$

$$r = \frac{1}{\frac{1}{3} - \frac{2}{15}} = 5 \text{ m}$$

$$CD = \sqrt{r^2 - 3^2} = \sqrt{5^2 - 3^2} = 4 \text{ m}$$

Answer: 4 m.